

Spring 2012 Benchmark

Given February 29, 2012

1.

What is the simplified form of $(5x^3)\left(-\frac{1}{2}x^2\right)(4x^3)$?

(A) $-10x^{18}$

(B) $10x^{18}$

(C) $10x^8$

(D) $-10x^8$

2.

What is the simplified form of $\frac{6y^2z^7}{18y^8z^3}$?

(A) $\frac{z^4}{3y^6}$

(B) $\frac{3z^4}{y^6}$

(C) $\frac{z^{10}}{3y^{10}}$

(D) $\frac{3z^{10}}{y^{10}}$

3.

If $3^{2x^2} \cdot 3^{4x^2} = 3^{54}$, what is the value of x ?

Ⓐ 3

Ⓑ ± 3

Ⓒ 9

Ⓓ ± 9

4.

What is the simplest form of $\left(\frac{9x^3y^{-4}}{15x^{-5}y^6}\right)^2$?

Ⓐ $\frac{3x^8}{5y^{10}}$

Ⓑ $\frac{3x^{11}}{5y^{14}}$

Ⓒ $\frac{9y^4}{25x^4}$

Ⓓ $\frac{9x^{16}}{25y^{20}}$

5.

Christina fires a paintball into the air. The paintball stays in the air for 5.4 seconds and is fired from a height of 1 foot. Christina knows that her equipment allows her to fire paintballs at the speed of 87.4 feet per second. What is the force of gravity (g) in feet per second using the formula, $0 = \frac{1}{2}gt^2 + v_0t + h_0$, where t = time of flight, v_0 = initial velocity, and h_0 = initial height?

- (A) about -8 feet per second
- (B) about -26 feet per second

- (C) about -32 feet per second
- (D) about -492 feet per second

6.

- Hank makes T-shirts to sell online. He can find his profit (P) using the formula $P = S - (C + H)$, where S is the sale price, C is the production cost, and H is the shipping cost. How much should Hank charge for a T-shirt that costs \$3.50 to make and \$4.30 to ship if he wants the profit to be \$10.00?

- Ⓐ \$2.20
- Ⓑ \$9.20
- Ⓒ \$10.80
- Ⓓ \$17.80

7.

- The population of a small town is growing yearly according to the formula $a_n = 175 + 50(n - 1)$, where n is the number of years the town existed. If the population of the town is now 525, how many years has the town existed?

Ⓐ year 6

Ⓑ year 7

Ⓒ year 8

Ⓓ year 12

8.

- Donna had an offer for a job starting at \$35,000 the first year and guaranteeing her a raise of \$1,100 per year for the next six years. Using the formula for an arithmetic sequence, what will her salary be during the fifth year?

(A) \$36,100

(B) \$38,300

(C) \$39,400

(D) \$40,500

9.

- The weight of a person on Earth varies directly with the weight which that person would have on Mars. A person who weighs 150 pounds on Earth would weigh 57 pounds on Mars. If a person weighs 210 pounds on Earth, about how much would that person weigh on Mars?

- (A) 41 pounds
- (B) 80 pounds
- (C) 553 pounds
- (D) 1,167 pounds

10.

- José and Melissa see a sign that reads, “Los Angeles 161 miles / 258 kilometers.” Melissa says this means there are 0.62 miles in 1 kilometer. José says this means there are 1.60 miles in 1 kilometer. Who is correct and why?

- Ⓐ Melissa is correct because dividing 161 by 258 is 0.62.
- Ⓑ Melissa is correct because 1 mile is smaller than 1 kilometer.
- Ⓒ José is correct because dividing 258 by 161 is 1.60.
- Ⓓ José is correct because 1 kilometer is larger than 1 mile.

11.

The mathematical statement of Charles's Law is $\frac{V}{T} = \text{a constant}$, where T is the Kelvin temperature (Celsius + 273) of a gas and V is the volume of gas.

At 398 K, the volume of a gas is 40 liters.

Approximately what volume will the gas occupy at 490 K?

- (A) 4,800 liters
- (B) 140 liters
- (C) 70 liters
- (D) 50 liters

12.

- The weight of a person of average build varies directly as the cube of that person's height. If a person six feet tall weighs 200 pounds, what weight would be predicted for a person who is five feet tall?

- Ⓐ 93 pounds
- Ⓑ 116 pounds
- Ⓒ 125 pounds
- Ⓓ 200 pounds

13.

- The weight of a ball varies directly with the cube of its radius. A ball with a radius of 3 inches weighs 6.75 pounds. What is the weight of a ball made of the same material with a radius of 4 inches?

- Ⓐ 9 pounds
- Ⓑ 12 pounds
- Ⓒ 13 pounds
- Ⓓ 16 pounds

14.

- What is the *approximate* perimeter of a quadrilateral with vertices $(2,5)$, $(5,4)$, $(4,-4)$, $(-1,-2)$?

(A) 12.7 units

(B) 21.6 units

(C) 24.3 units

(D) 26.3 units

15.

- A parallelogram has the vertices $(6,1)$, $(8,5)$, $(-5,5)$, and $(-7,1)$. At what point do the diagonals intersect?

Ⓐ $\left(\frac{1}{2}, 3\right)$

Ⓑ $(1, 6)$

Ⓒ $(5, 4)$

Ⓓ $\left(5\frac{1}{2}, 2\right)$

16.

- Which of the statements is true about the line segments formed from the points $W(2,5)$, $X(2,-3)$, $Y(-2,-3)$, and $Z(-2,0)$?

- (A) WX is parallel to YZ .
- (B) WY is parallel to XZ .
- (C) WZ is perpendicular to XY .
- (D) WX is perpendicular to YZ .

17.

- A line segment has endpoints $X (-6,7)$ and $Y (4,9)$. Which coordinates are endpoints for a line segment perpendicular to XY ?

- Ⓐ $(1,3)$ and $(6,4)$
- Ⓑ $(2,7)$ and $(1,2)$
- Ⓒ $(5,10)$ and $(6,5)$
- Ⓓ $(12,3)$ and $(7,4)$

18.

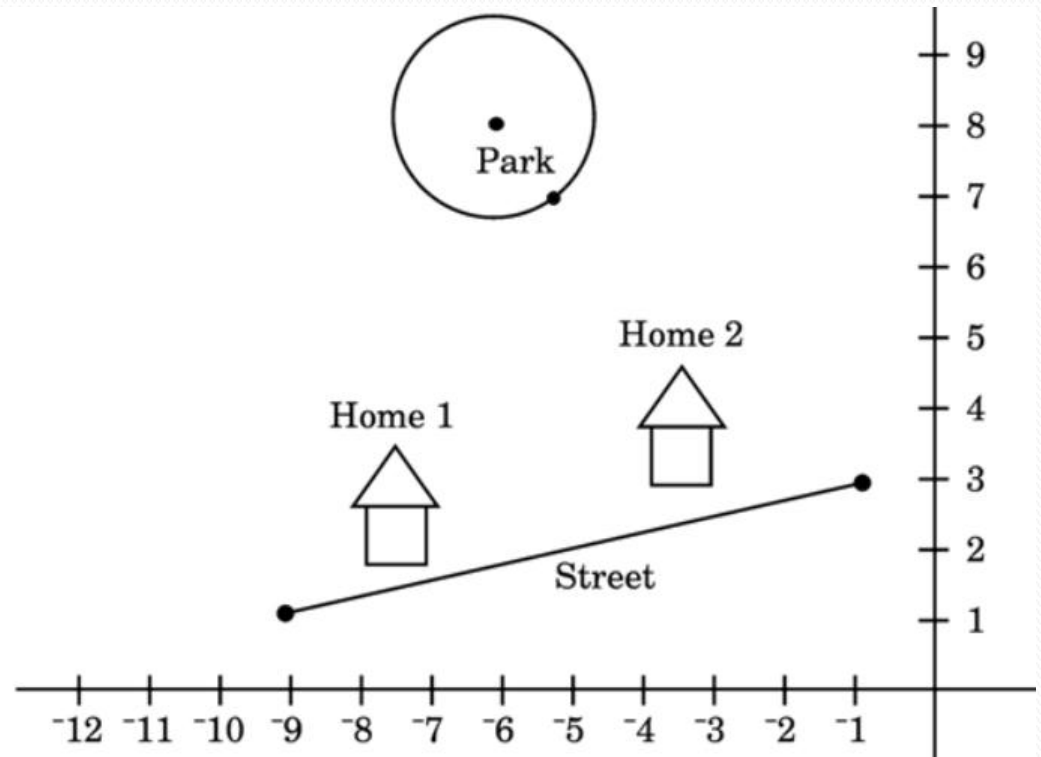
- A path is to be constructed between two houses in order to allow residents access to a community park. The situation is modeled below.
- The residents insist the path be perpendicular to the street through the point $(-5, 2)$. What is the equation of the line of the sidewalk?

(A) $y = -4x - 2$

(B) $y = -4x + 2$

(C) $y = -4x - 18$

(D) $y = -4x + 18$



19.

- What is k if the lines with the equations $y = kx + 5$ and $2y = (k + 4)x - 1$ are parallel?

Ⓐ -1

Ⓑ 2

Ⓒ 4

Ⓓ 5

20.

- The midpoint of a line segment is $(-3, 4)$. The endpoints of the line segment are $(x, 9)$ and $(-4, -1)$. What is the value of x ?

Ⓐ $-\frac{7}{2}$

Ⓑ $-\frac{1}{2}$

Ⓒ -2

Ⓓ -10

21.

- A gardener is sketching a model of a triangular flowerbed. On a coordinate grid, the vertices of the flowerbed are located at $(-1,1)$, $(1,7)$, $(-3,6)$. The bricks that will be used to border the flowerbed are each 1 unit long and cost \$1.29 each. ***Approximately*** how much will it cost to enclose the flowerbed?

Ⓐ \$12

Ⓑ \$16

Ⓒ \$21

Ⓓ \$109

- Three students' grades on math quizzes are given in the matrix to the right.
- On which quiz was the average score the highest?

| Math Quiz Grades | | | | |
|------------------|--------|--------|--------|--------|
| | Quiz 1 | Quiz 2 | Quiz 3 | Quiz 4 |
| Ken | 89 | 85 | 92 | 94 |
| Jim | 92 | 91 | 89 | 90 |
| Judy | 88 | 87 | 90 | 84 |

(A)

Quiz 1

(B)

Quiz 2

(C)

Quiz 3

(D)

Quiz 4

23.

- Which grade, if exchanged for Bob's lowest grade, would make his overall average a B? (Choose the minimum grade.)

Course Averages

| | Algebra I | Spanish | History | English |
|-------|-----------|---------|---------|---------|
| Bob | 75 | 79 | 78 | 84 |
| Jan | 81 | 82 | 82 | 87 |
| Steve | 86 | 89 | 83 | 92 |

(A) 92

(B) 95

(C) 96

(D) 99

Grading Chart

| Letter Grade | Course Average |
|--------------|----------------|
| A | ≥ 92 |
| B | 84–91 |
| C | 79–83 |
| D | 70–78 |
| F | < 70 |

- Wind chill is the temperature ($^{\circ}\text{F}$) the body feels when air temperature and wind speed are combined. The matrix below shows the wind chill for wind speeds (rows) from 10 to 40 miles per hour and air temperatures (columns) from 30°F to -10°F . Which is the **best** estimate of the wind chill for a wind speed of 25 miles per hour and an air temperature of 25°F ?

| | | Air Temperatures | | | | |
|------------|----|------------------|-----|-----|-----|--|
| Wind Speed | 10 | 20 | 30 | 40 | 50 | |
| | 21 | 9 | -4 | -16 | -28 | |
| | 17 | 4 | -9 | -22 | -35 | |
| | 15 | 1 | -12 | -26 | -39 | |
| | 13 | -1 | -15 | -29 | -43 | |

Ⓐ 5

Ⓑ 7

Ⓒ 9

Ⓓ 12

25.

- A travel agency at the Outer Banks wrote a pamphlet on the attractions most requested by guests. In June, they had 43 requests for information on lighthouses, 32 on beaches, and 18 on fishing. In July, there were 27 requests for information on fishing, 34 on lighthouses, and 51 for beaches. Which matrix organizes the data so that the rows are June and July and the columns are lighthouse, beaches, and fishing respectively?

Ⓐ $\begin{bmatrix} 43 & 27 \\ 32 & 34 \\ 18 & 51 \end{bmatrix}$

Ⓑ $\begin{bmatrix} 43 & 34 \\ 32 & 51 \\ 18 & 27 \end{bmatrix}$

Ⓒ $\begin{bmatrix} 43 & 32 & 18 \\ 27 & 34 & 51 \end{bmatrix}$

Ⓓ $\begin{bmatrix} 43 & 32 & 18 \\ 34 & 51 & 27 \end{bmatrix}$

26.

- John and Tito are comparing their monthly spending on food, music, and electricity.
- How much more did John and Tito spend on each item in February than in March?

$$\text{January} = \begin{bmatrix} 600 & 210 & 400 \\ 450 & 320 & 380 \end{bmatrix}$$

$$\text{February} = \begin{bmatrix} 650 & 300 & 360 \\ 600 & 270 & 380 \end{bmatrix}$$

$$\text{March} = \begin{bmatrix} 600 & 200 & 350 \\ 550 & 235 & 340 \end{bmatrix}$$

$$\textcircled{\text{A}} \begin{bmatrix} -50 & -100 & -10 \\ -50 & -35 & 40 \end{bmatrix}$$

$$\textcircled{\text{B}} \begin{bmatrix} 50 & 100 & 10 \\ 50 & 35 & 40 \end{bmatrix}$$

$$\textcircled{\text{C}} \begin{bmatrix} 50 & 90 & -40 \\ 150 & -50 & 0 \end{bmatrix}$$

$$\textcircled{\text{D}} \begin{bmatrix} 50 & 30 & -20 \\ 50 & 35 & -70 \end{bmatrix}$$

Given the matrices below, what is $R - 2T$?

$$R = \begin{bmatrix} -19 & 5 \\ -22 & 7 \end{bmatrix}, \text{ and } T = \begin{bmatrix} -8 & 13 \\ 6 & 34 \end{bmatrix}$$

$$\textcircled{\text{A}} \begin{bmatrix} -46 & 2 \\ -31 & 48 \end{bmatrix}$$

$$\textcircled{\text{C}} \begin{bmatrix} -30 & 4 \\ -57 & -20 \end{bmatrix}$$

$$\textcircled{\text{B}} \begin{bmatrix} -35 & 17 \\ 4 & 75 \end{bmatrix}$$

$$\textcircled{\text{D}} \begin{bmatrix} -3 & -21 \\ -34 & -61 \end{bmatrix}$$

28.

- What is matrix J if $3K + 2J = H$?

$$H = \begin{bmatrix} 4 & 1 \\ -3 & -2 \\ 0 & 8 \end{bmatrix}$$

$$K = \begin{bmatrix} 3 & 0 \\ 3 & 7 \\ 2 & -5 \end{bmatrix}$$

$$\textcircled{\text{A}} \begin{bmatrix} -\frac{5}{2} & \frac{1}{2} \\ -6 & -\frac{23}{2} \\ -3 & \frac{23}{2} \end{bmatrix}$$

$$\textcircled{\text{B}} \begin{bmatrix} -\frac{13}{2} & -\frac{1}{2} \\ -3 & -\frac{19}{2} \\ -3 & \frac{7}{2} \end{bmatrix}$$

$$\textcircled{\text{C}} \begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ -3 & -\frac{9}{2} \\ -1 & \frac{13}{2} \end{bmatrix}$$

$$\textcircled{\text{D}} \begin{bmatrix} -\frac{7}{2} & -\frac{1}{2} \\ 0 & -\frac{5}{2} \\ -1 & -\frac{3}{2} \end{bmatrix}$$

29.

- The matrix shows the number of employees under each pay that worked at a plant in town during different shifts.
- If all employees worked 8 hour shifts, what were the total wages that this company paid on Saturday?

(A) \$248

(B) \$304

(C) \$522

(D) \$1,984

**Number of Employees Working on
Saturday at Various Pay Rates**

| | \$6.25 | \$6.50 | \$7.00 | \$7.50 |
|---------|--------|--------|--------|--------|
| Day | 8 | 3 | 5 | 1 |
| Evening | 10 | 2 | 2 | 1 |
| Night | 4 | 1 | 0 | 1 |

- The table below shows the height of a plant as it grows.
- Based on the line of best fit, what does the y -intercept mean?

Plant Height

| Time (in months) | Height (in cm) |
|----------------------------|--------------------------|
| 3 | 7 |
| 5 | 11 |
| 7 | 15 |
| 9 | 19 |

- (A) After 0 months, a plant will be 1 cm tall.
- (B) After 0 months, a plant will be 3 cm tall.
- (C) After 1 month, a plant will be 0 cm tall.
- (D) After 2 months, a plant will be 0 cm tall.

31.

- A business buys a computer, which decreases in value over time. This value, V , can be related to the time in years, y , by the equation $V = -687.50y + 3,000$. What does the coefficient of y represent?

- Ⓐ the final value of the computer
- Ⓑ the decrease in value each year
- Ⓒ the initial cost of the computer
- Ⓓ the ratio of the values of the computer from one year to the next

- Anna earns money by typing students' papers. She uses the equation $C = 0.7p + 3$ to calculate what she charges. C is the total cost in dollars of what she will charge, and p is the number of pages. What are the interpretations of slope and intercept in the equation?

- (A) Slope: number of pages per hour
Intercept: cost of the first page
- (B) Slope: rate at which Anna types
Intercept: initial charge
- (C) Slope: cost per additional page
Intercept: cost of the first page
- (D) Slope: charge per page of typing
Intercept: initial charge

33.

- Mary has written 10 pages for her novel. She plans to write 15 additional pages per month until she is finished. Which equation represents the total number of pages written after any number of months?

(A) $P = 10m + 15$

(B) $P = 10m - 15$

(C) $P = 15m + 10$

(D) $P = 15m - 10$

34.

- A business buys a computer for \$3,000. After 4 years, the value of the computer is expected to be \$250. The value, V , can be related to the time in years, t , in a linear model. In how many years could the value be expected to reach zero?

(A) 4.2

(B) 4.36

(C) 5.0

(D) 5.24

- The students in the ninth grade earned the following grades in math and science. Mr. Miller believes that students' science grades are dependent on their math grades. Which is the equation for the line of best fit for the data that supports Mr. Miller's theory?

Ninth Grade Students

| Student | A | B | C | D | E | F | G | H | I |
|---------|----|----|----|----|----|----|----|----|----|
| Math | 76 | 89 | 84 | 79 | 94 | 71 | 79 | 91 | 84 |
| Science | 82 | 94 | 89 | 94 | 94 | 84 | 68 | 89 | 84 |

(A) $y = -0.61x + 35.31$

(B) $y = 0.61x + 35.31$

(C) $y = 0.61x - 35.31$

(D) $y = 0.61x$

- The table below shows the heights and weights of 8 basketball players.
- Assuming a linear relationship, what would be the weight of someone 70 in. tall?

Height and Weight of Basketball Players

| Player | Height (in.) | Weight (lb) |
|--------|--------------|-------------|
| 1 | 75 | 184 |
| 2 | 74 | 185 |
| 3 | 75 | 185 |
| 4 | 78 | 195 |
| 5 | 76 | 205 |
| 6 | 80 | 205 |
| 7 | 80 | 221 |
| 8 | 81 | 215 |

(A) 145 lb

(C) 165 lb

(B) 155 lb

(D) 175 lb

37.

- Use the line of best fit to determine the estimated sporting goods sales in 1990. If the actual sales were \$50.7 billion, what is the percent difference between the actual sales and the estimated sales?

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|------|------|------|------|------|------|
| Sporting Goods Sales (billions of dollars) | 74.4 | 74.3 | 77.8 | 79.8 | 85.8 | 89.8 |

- (A) 0% – 5% difference
- (B) 5% – 15% difference
- (C) 15% – 25% difference
- (D) more than 25% difference

38.

- The function $H(x) = 2.59x + 47.24$ is used to estimate the height of a woman in centimeters, where x is the length of her thigh bone. What is the ***approximate*** height of a woman whose thigh bone measures 54 centimeters?

- (A) 103.83 centimeters
- (B) 155.24 centimeters
- (C) 187.10 centimeters
- (D) 202.48 centimeters

39.

- Gym 1 charges \$45 a month plus \$2 for each visit. Gym 2 charges \$36 a month plus \$5 for each visit. At what minimum number of visits per month does Gym 1 become less expensive than Gym 2?

(A) 2

(B) 3

(C) 4

(D) 5

40.

- The table to the right compares the number of treadmills at local gyms to the number of members.
- How many treadmills should the gym have if its membership is 180 people?

- (A) 60 treadmills
- (B) 63 treadmills
- (C) 65 treadmills
- (D) 68 treadmills

Total Gym Treadmills

| Members | Treadmills |
|---------|------------|
| 140 | 46 |
| 160 | 56 |
| 130 | 38 |
| 150 | 51 |
| 200 | 73 |

41.

- The yearly cost of tuition and fees at a public four-year college can be estimated by the linear function $f(x) = 130x + 1,980.5$, where x is the number of years after 2005 and $f(x)$ is the total cost. In what year will the tuition and fees exceed \$2,500?

(A) 2008

(B) 2009

(C) 2010

(D) 2011

42.

- The cost of a cab ride is \$4.25 plus \$0.35 per mile. What is the number of miles traveled if the cost is \$14.75?

(A) 30 miles

(B) 35 miles

(C) 42 miles

(D) 54 miles

43.

- A restaurant charges a rental fee for its ballroom plus a cost per person. The cost for different size groups is shown to the right.
- What does the y -intercept represent for the data set?

Restaurant Rates

| Number of People | Total Bill |
|------------------|------------|
| 10 | \$152 |
| 12 | \$168 |
| 14 | \$184 |
| 16 | \$200 |

- (A) The rental fee will be \$0 when there are 72 people.
- (B) The rental fee will be \$72 when there are zero people.
- (C) The rental fee will be \$2 when there are zero people.
- (D) The rental fee will be \$0 when there are two people.

- The table to the right shows the amount of money in Joe's bank account over a period of time. What conclusion can be drawn from the slope of a linear model of these data?

Joe's Bank Account Activity

| Time (in days) | Amount |
|-------------------|--------|
| 5 | \$698 |
| 15 | \$690 |
| 25 | \$682 |

- (A) Every five days, Joe spends \$4.
- (B) Every four days, Joe spends \$5.
- (C) Every five days, Joe earns \$4.
- (D) Every four days, Joe earns \$5.

45.

- A computer repairman charges \$50 to come to a home or office, plus \$35 per hour. During one week, he visits eight homes or offices, and his total income is \$1,450. How many hours does he spend working on computers?

Ⓐ 30 hours

Ⓑ 35 hours

Ⓒ 40 hours

Ⓓ 45 hours

46.

- Tickets for a dance were \$10 for single tickets and \$16 for a pair of tickets. There were 271 people who attended the dance. Ticket sales totaled \$2,278. How many single tickets and how many pairs of tickets were sold?
- Ⓐ 55 single tickets and 108 pairs of tickets
 - Ⓑ 199 single tickets and 72 pairs of tickets
 - Ⓒ 108 single tickets and 55 pairs of tickets
 - Ⓓ 72 single tickets and 199 pairs of tickets

47.

- Linda has a total of \$4,000 invested in two accounts. One account pays 5% interest, and the other pays 8% interest. How much does she have invested in each account if her total interest for a year is \$284?

- Ⓐ \$1,200 at 5% and \$2,800 at 8%
- Ⓑ \$1,600 at 5% and \$2,400 at 8%
- Ⓒ \$2,400 at 5% and \$1,600 at 8%
- Ⓓ \$2,800 at 5% and \$1,200 at 8%

48.

- Robert needs 90 liters of a 60% alcohol solution. He has available a 20% alcohol solution and an 80% alcohol solution. How many liters of each solution should he mix to obtain 90 liters of a 60% alcohol solution?

- (A) 30 liters of the 20% solution and 60 liters of the 80% solution
- (B) 35 liters of the 20% solution and 55 liters of the 80% solution
- (C) 40 liters of the 20% solution and 50 liters of the 80% solution
- (D) 45 liters of the 20% solution and 45 liters of the 80% solution

49.

- When you add Nikki and her mother's age together they equal 51. Nikki's mother's age is one less than three times Nikki's age. How old is Nikki's mother?

(A) 34

(B) 35

(C) 37

(D) 38

50.

- Given the inequalities $y < 2x + 1$ and $y > -2x - 3$, which point would be in the solution?

Ⓐ $(0, 0)$

Ⓑ $(-1, -1)$

Ⓒ $(-1, 1)$

Ⓓ $(-4, -4)$